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SCIENTIFIC FARMING.

ADDRESSES

— BY —

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Director of the Canadian Experimental Farms,

— AND —

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Government Entomologist and Botanist.

DELIVERED BEFORE THE NORTH LANARK FARMERS'
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SCIENTIFIC FARMING

1914

ADDRESSES

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THE DOMINION CENTRAL EXPERIMENTAL FARM.

In to-day's issue we publish a report of the proceedings of the annual meeting of the North Lanark Farmers' Institute, held at Almonte, a few days ago, in which will be found matter of great interest to agriculturists, and incidentally to the community in general.

The address of Prof. Saunders is marked by the clearness which his utterances and writings are known to possess, and it certainly affords an answer to the question which is often asked: What is the use of Experimental Farms? He shows that they were first established by associations of farmers in Germany, who saw the need for the work they could do; they were afterwards taken up by the Government of that country; and thence they soon spread to other countries which have made any advance in agriculture. There are many experiments in practical agriculture which are important to every farmer, but which every farmer has neither the leisure nor the facility to try. It is, therefore, in the common interest, and we use this term in the widest sense, for the farming interest affects the whole country, that these experiments should be tried by the Government; and the farming population afforded the advantage of the results. We think the Government of Sir John A. Macdonald may fairly be congratulated upon the progress which has been already made and which is so clearly described in the address of Mr. Saunders. And it cannot be without interest to the Premier's constituents in Carleton that the Central Experimental Farm for the Provinces of Quebec and Ontario should be established in their country. It must also be a matter of congratulation for the Hon. John Carling, the Minister of Agriculture, to see the very successful working of one of his most cherished projects. Still further, the farmers of the country may be congratulated on the fact that practical agriculture is being intelligently and actively treated as an applied science by the Government of the Dominion, in such way as to keep it abreast, if not to place it in the front rank, with the best practice in agriculture in other countries, instead of being allowed to drift along as best it might by the light of the sometimes effective, perhaps, rule of thumb, or experiments of individual farmers, very often conducted under difficulties. One practical benefit which appears to be clear in the steps already taken, is that a new wheat has been imported, which is described as being about the equal of the

Red Fife in hardness and excellence, but which has, for parts of this Dominion, the almost inestimable value of ripening from one to two weeks earlier. If this wheat had been available in Manitoba and the districts of the North-West in the years 1883 and 1884, it would have prevented what was really a calamity; and it may be broadly stated that the introduction of this wheat alone greatly outweighs in value to the country all the expenditure which has been made, or we might almost say which can be made, on the Experimental Farms. Prof. Saunders shows that many grains and roots have a tendency to run out, and if practical information is afforded to farmers on this point, it cannot fail to be of great importance to them. We, ourselves, hope greatly for the results from the horticultural experiments which have been set on foot. If these succeed in furnishing information to the farmers of the old provinces of the particular fruit trees, which are better adapted to their circumstances than those at present found, the country will be made both richer and more pleasant to live in thereby. This remark even more strongly applies to Manitoba and the North-West. There the lack of fruit trees is a great deprivation. But it is believed that those varieties, which succeed in Northern Russia, will succeed there; and this, we understand, will be tried by the experiments now being conducted under Prof. Saunders' direction. And even in the matter of seed testing, if farmers in Canada can, in many instances, as they have been in other countries, be saved from the evil consequences of sowing seeds of which a sufficient percentage will not germinate, both they and the country will be saved from loss. Prof. Saunders shows that a good beginning has been made in this respect, and that losses have been prevented. These tests are easily available. Arrangements have been made with the Post Office Department for the transmission of the seeds, and each farmer is promptly informed of the value of the specimens sent by him for examination. There are many other points in the report before us which we are tempted to enlarge upon, but our object is less to refer in detail to the matters so clearly stated in the address as to direct attention to it.

The address of Mr. James Fletcher, the Dominion Entomologist and Botanist, also contains matter of great interest and importance to farmers; we can only, however, in this place, direct attention to it.

(From the Report in the Ottawa Daily Citizen, December 15th, 1887.)

LANARK FARMERS.

Annual Meeting of their Institute for Business Purposes.

ADDRESSES BY PROF. SAUNDERS AND MR. JAMES FLETCHER

Of the Government Central Experimental Farm, Ottawa.

QUESTIONS OF GREAT INTEREST DISCUSSED.

Almonte, 10th.—The annual meeting of the North Lanark Farmers' Institute for the election of officers and other business was held in the Town Hall here to-day. Mr. C. M. Simpson, President of the Institute, presided, assisted by Mr. John Steele, Secretary.

After some preliminary discussions by members of the society an address was delivered by Prof. Saunders, F.R.S.C., the Director of the Government Experimental Farms.

Experimental Agriculture and its Value to the Farmers.

Prof. Saunders said: It affords me a great deal of pleasure, indeed, to be with you to-day, a double pleasure for the reason that last year when your Secretary was kind enough to invite me to come to your annual meeting, and I had made every arrangement to attend, the evening before I was attacked with a violent illness which confined me to my bed for some days. I have listened with much interest to your discussion of subjects connected with farming which are of so much importance to yourselves and to the country. I think it is a good sign when institutes of this kind are so well patronized and so well attended, notwithstanding the inclemency of the weather; when farmers meet together to discuss the results of their own experience, the character of the crops they have grown under different conditions of soil, and different circumstances, and compare notes and thereby benefit each other by the interchange of ideas in all such matters.

It indicates that a community of this sort consists of thinking men. A farming community that exercises itself in that direction will always be a prosperous one, and will be well to the front in all departments of agricultural work.

AGRICULTURE AND EXPERIMENTAL SCIENCE.

Agriculture is and always has been an experimental science, and in the very nature of the subject it must always be. Most of the experience we have in agriculture has been obtained by the practical experimenting of individual farmers, a few facts gleaned here and there, and these added into one great sum constitute our present knowledge of the art. Up to within a recent period very little had been done either by societies or by Governments to aid individual effort in this particular line of work. It was only about thirty years ago that the first agricultural experimental station was established in Germany, and this was the first effort made in any part of the world to bring to bear on farming operations the benefits of scientific training. A number of farmers met together in one of the provinces of Germany and there resolved to establish an experimental farm on a small scale in order to save them individually the cost and trouble of each one experimenting for himself. They selected a manager for this farm, and started a course of experiments, and shortly after applied to the Government to help them in the matter. The Government enquired into

the subject, and believing that the scheme was a good one, and that it was likely to produce excellent results, voted a sum of money to aid in the work. Within a few years several similar institutions were started in other parts of Germany, and they have gained in popular favour from year to year until now. In most countries in Europe holding anything like an advanced position in agriculture, there are many of those experimental institutions where scientific work is carried on regularly, the results are given to the farming community, and they reap the benefit of the experience so gained for them. From the outset the cost and maintenance of those institutions has been borne almost entirely by the Government of the country in which they are located.

THE VALUE OF SCIENTIFIC EXPERIMENTS TO THE FARMER.

It has often been asked, "Of what practical use are those institutions to the farmer?" Well, there are many experiments which could and should be carried on to benefit the agriculturists which demand more time, more risk and more careful attention than farmers can afford to give, and the use of apparatus which farmers have not at their command in order to work out satisfactorily all the details connected with the tests, so that there are classes of experiments which farmers cannot well undertake for themselves, and which are of great value to the community.

CLOVER AS AN ACCUMULATOR OF NITROGEN.

There is not a farmer present, I presume, but knows the value of clover as a green manure. It is a subject that everyone is familiar with, and there is, perhaps, no plant at present known which is so valuable an agent in nourishing the soil as a good crop of clover ploughed in green. If anyone asks why it is so, he is usually met with the answer, "we know it is so, because it is the result of our experience." Now if we bring chemistry to bear on the question, we find that clover contains a large proportion of an element which is a very important fertilizer of the soil—nitrogen. This element exists in the soil in considerable proportions. It is found in every soil, and it forms as well the great bulk of the atmosphere we breathe. In the soil it exists in two conditions: One form, which is called available nitrogen, is that form in which plants can take it up readily as food; while in the other form, known as unavailable nitrogen, it is locked up in the soil and cannot be assimilated as plant food until it has undergone a change, which is usually brought about in a very gradual manner by the cultivation of the soil and the exposure of every part of it to the action of the atmosphere, which gradually converts the unavail-

able nitrogen into the available form, and in that way the fertility of the soil is partially maintained. It has been shown by analysis that clover accumulates nitrogen in a large proportion from some source during its growth. It is not definitely known whether this nitrogen is obtained from that which is unavailable to other plants, or from the air; but it is known that a given weight of clover contains nearly fifty times as much of this valuable element, as the same weight of the wheat plant. Hence, if clover, with its weight of fertility, is ploughed under, it gives to the soil a dressing which will serve for the enriching of several succeeding crops.

UNKNOWN STORES OF NITROGEN.

The knowledge of this fact in connection with clover leads to another consideration. Clover is only one member of a very large family of plants which are known to botanists as leguminous plants, which include all the lupins, vetches, tares, &c., some of which are natives of this country and some of foreign countries. If clover has this quality of storing up nitrogen, other plants may have the same and some a superior power in that direction, one can at once see that here is a field for experiment in a direction which would be exceedingly valuable to the whole farming community, to ascertain which of the leguminous plants, if any, are as good or better than clover for this purpose. There are some native to the North of Europe and many more found in different sections of this great Dominion, all of which should be experimented with in order to ascertain whether they could not be made useful to agriculture, for it has been well said that the power of one plant to store up food for future crops of other plants lies at the very foundation of successful agriculture. Nitrogen is abundant in all animal fertilizers, and it is the presence of that element which gives to these fertilizers their chief value.

IMPORTANCE OF PERMANENT PASTURES.

Another point which I might use in illustration is the importance to farmers of permanent pastures for cattle. It is very uncertain, in view of the immense fertile wheat-growing plains which we have in the North-West, whether farmers in the east will be able to compete in grain growing with the farmers of the Prairie Provinces. Indeed it is very doubtful if they can. In that case the farmers of Eastern Canada will have to fall back on such lines of agriculture as they can make most profitable, and one of these is stock raising. Permanent pasture may be defined as a mixture of perennial grasses containing those which will ripen at different periods during the season. A crop of timothy ripens and is harvested early in the year, after which

there is a long period when that field is useless for the purpose of pasture, and not until the growth is strong enough, and has body enough to provide good grazing, would a farmer think of pasturing his cattle on it. But in permanent pastures you get a selection of grasses, which live from year to year, some of which will ripen early in the season, some in the middle of the summer, and others later on, so that the cattle may have a succession of that succulent food which they need and have it in such abundance as will enable them to put on flesh rapidly.

PROVIDENCE HAS NOT PLACED ALL THE GOOD GRASSES IN ANY ONE PART OF THE WORLD.

Most of the grasses which we have in cultivation have come to us from various parts of Europe, and there are some varieties in our own country which are quite as promising, perhaps, as some of the European sorts. In my late journey in the North-West I paid some attention to the native grasses, and found varieties there which seem to me to be quite promising, judging from their habit of growth, and from the fact that cattle show such a preference for them. When brought under cultivation, there may be found among them species quite equal and perhaps superior in some respects to those at present in use. There are also in the North-West and in the Western States, some varieties which are capable of standing very dry weather, and some others adapted to very cold climates. By growing judicious mixtures of these grasses, we hope to ascertain their true value. This important work will be carried on extensively at the Experimental Farm, and the object will be to show which are the best varieties, bring them into notice, and also to take such steps as will make them available to farmers. There are a score or more different kinds of grasses which can be obtained from seed dealers in Europe and other countries, many of which would be exceedingly useful if their valuable qualities were better known. These facts serve to show that there are lines of experimental work which at first sight might appear trivial, but are expected in the end to produce results of great importance to the stock interests of this country. Such experiments cannot be undertaken by the farmer. Few of you could afford the time or expense required to travel to the North-West and other places in search of such products; but if this can be done for you, the information obtained for your guidance and the material made available for your use; you must admit that great good is likely to result from such work.

DEGENERATION OF ROOTS AND CEREALS.

All our cereals, roots and tubers are, to a great extent, artificial products. You do not find wheat, oats or barley growing anywhere in nature, as we have them now! You do not

find potatoes like those in cultivation growing wild. The potato originated from an insignificant wild variety, which, by cultivation and careful hybridization, has been brought to its present high standard of excellence. So with wheat, oats and barley, and all field crops. These improved plants and roots, good as they are, are liable to constant variation and to frequent deterioration—that is, they often “run out.” If you recall the varieties of grain and potatoes which were grown twenty years ago, you will find very few of them today. This points to the importance of continuous experimental work with new varieties of grain and other crops, so that by the frequent introduction (as in the case of stock) of new blood there may be imparted to these products that vigour of growth and fertility of character which will admit of there being cultivated to greater perfection and profit.

WASTEFUL FARMING.

Our farming during the past has not always been conducted in the most economical manner. Crops have sometimes not been sown with needed promptness, the fertilizers at command have not been made the best of, and much land that would have yielded good results has for want of proper drainage and care remained unproductive to the owner. Loss to the country has also resulted from lack of information regarding the necessity of a proper rotation of crops. Canadian farmers will require to be more careful in these particulars if they would maintain for their country in these days of keen competition and improved appliances that well deserved pre-eminence in agriculture which she has hitherto enjoyed. I might enlarge here indefinitely, but perhaps I have said enough in the few thoughts presented to show that there is practically no limit to experimental work, the results of which, when its true value is determined and made known, will be of inestimable consequence to farmers everywhere; and when I say that the experimental farms established by the Dominion Government are to take up this class of work especially, and report on it frequently for the benefit of the farmers, I think I have fairly answered the question, “What good will those farms be to the agricultural community?” The establishment of so many of these experimental institutions in Europe led to the consideration of the subject in America, and about thirteen years ago the first of these experimental stations were established in the State of Connecticut. Since then a number of similar institutions have been started, supported by annual grants from the legislatures of the different States in which they have been located, until the importance of the subject has so grown on the farmers in the

United States that for a year or two past the people have been agitating for more liberal support from the general Government for such institutions, and last year Congress passed a bill known as "The Hatch Bill," which provides for an annual appropriation of nearly \$500,000, to be divided amongst the different States, to be devoted entirely to this experimental work in agriculture, horticulture and forestry. In the meantime the Canadian Government has also been looking after the interest of the farmers. In 1884 they appointed a committee to enquire into this subject, and from the opinions expressed by practical farmers, who were called before this committee, the Government were led to consider the expediency of

PROVIDING EXPERIMENTAL FARMS FOR CANADA.

Our worthy Premier, Sir John Macdonald, who always takes the warmest interest in everything that tends to the prosperity of the agricultural classes, asked Parliament for an appropriation of \$20,000 towards the purchase of a site for an experimental farm. In November of that year I was requested by the Government to visit the different agricultural stations in the United States; and also to ascertain by correspondence the working of similar institutions in Europe, and to prepare a report for the Government which might give them such additional information as they required in order to reach some conclusion regarding this work of experimental agriculture. I travelled through all the Western and Northern States, and visited every agricultural institution located anywhere near the Canadian boundary, and submitted a report of my investigations. The result was the passage of the bill known as "An Act respecting Experimental Farm Stations," which provided for the establishment of five experimental farms, one of which was to be located near Ottawa, to serve the purposes of Ontario and Quebec jointly; one in the Maritime Provinces, to serve the purposes of those provinces jointly; one in Manitoba; one in the North-West Territories, and one in British Columbia.

THE OBJECTS AIMED AT

in establishing those farms might be better presented to you perhaps in the wording of the Act itself. The works to be undertaken were as follow:

(a.) Conduct researches and verify experiments designed to test the relative value, for all purposes, of different breeds of stock, and their adaptability to the varying climatic or other conditions which prevail in the

several provinces and in the North-West Territories;

(b.) Examine into the economic questions involved in the production of butter and cheese;

(c.) Test the merits, hardiness and adaptability of new or untried varieties of wheat or other cereals, and of field crops, grasses and forage-plants, fruits, vegetables, plants and trees, and disseminate among persons engaged in farming, gardening or fruit growing, upon such conditions as are prescribed by the Minister, samples of the surplus of such products as are considered to be specially worthy of introduction;

(d.) Analyse fertilizers, whether natural or artificial, and conduct experiments with such fertilizers, in order to test their comparative value as applied to crops of different kinds;

(e.) Examine into the composition and digestibility of foods for domestic animals;

(f.) Conduct experiments in the planting of trees for timber and for shelter.

(g.) Examine into the diseases to which cultivated plants and trees are subject, and also into the ravages of destructive insects, and ascertain and test the most useful preventives and remedies to be used in each case;

(h.) Investigate the diseases to which domestic animals are subject;

(i.) Ascertain the vitality and purity of agricultural seeds; and

(j.) Conduct any other experiments and researches bearing upon the agricultural industry of Canada, which are approved by the Minister.

It will be seen from this category that provision is made for experimental work in all departments of agriculture in each of the Provinces. In order to carry on this work the Act authorized the employment of a director, who was to have supervision of all the institutions; of a Horticulturist, who was to take charge of the department of horticulture at Ottawa; of a Botanist and Entomologist (the two offices combined), and I am happy to say that Mr. Fletcher, the gentleman appointed to that important branch, is present and will be able to speak for himself. It also provided for the appointment of a Chemist, whose duty it will be to analyse fertilizers and conduct all chemical operations; and also for the appointment of an Agriculturist who shall be specially charged with the management of the field crops and stock. When the site for the Central Experimental Farm was located, possession of it was not secured until November of last year—too late to accomplish much, but there was found time to plough about 20 acres and gather up some loose stones that were scattered over the ground. Winter then set in and put a stop to all out-door work until

the spring. In the meantime a small building was erected for an office and a glass structure in which

TO TEST THE VITALITY OF SEEDS,

which was one of the works the Act prescribed should be undertaken. This work was successfully carried on last winter, and 187 samples of wheat and other cereals, grass seeds and other field crops, were sent in to the institution to be tested. The vitality of these were determined and the percentage that would grow under favourable conditions reported to the farmers sending them as promptly as possible. That department of work has been of much practical value, as will be seen from the bulletin that will be issued from the farm very shortly, giving details of this work. It resulted in farmers being saved, in many instances, from sowing seed which would have given them very little return for their labour. In the harvesting of grain it sometimes happens that after it has been cut and put in the mow it will heat and its vitality as seed will be injured; there are other causes also which may occur which so affect seed grain as to make its germination more or less a matter of uncertainty. The Experimental Farm offers to any farmer in the Dominion the advantages of sending in, free of postage, samples of seed to be tested in the soil and also in another form, in duplicate, one test being a check on the other, and returns are made to the farmers without any charge or expense. I hope that the gentlemen present, will all of them avail themselves of the advantages offered in this department of our work as freely as they think fit. We shall not complain of any number of samples being sent, and shall endeavour to meet any requisition that may be made on us in this respect. Seed testing has already begun, and we should like to have samples sent in as early as possible, so that there may not be too much of a rush as seed time approaches. It sometimes takes a fortnight or three weeks to properly test the germinating power of some seeds.

EARLY RIPENING WHEAT.

Another matter undertaken during the past winter was the importation from Northern Russia of an early ripening wheat. Farmers in some parts of the North-West have suffered several years, some seasons much worse than others, from frozen wheat, and it was believed that if a variety of wheat could be obtained that would ripen a week earlier than any sort at present available it would result in most instances in the saving of the crop. While frozen wheat has some value still the saving of the crop from frost would make a difference to the farmers of between 55cts., and about 25cts. per bushel.

The new seed wheat was obtained from a district in Russia, 600 miles north of where we are to-day, and where the season is much shorter than in any of the settled portions of our North-West Territories. This wheat has ripened from ten to fifteen days earlier than any other variety of wheat cultivated there. It has shown great vitality, and is believed to be nearly, if not quite equal, in every respect, to any other sort in cultivation. In Ontario and Quebec it has not succeeded so well on account of the dry season we have had. In consequence of its early ripening quality it has not had quite the chance that later ripening varieties have had, and hence the grain is somewhat shrivelled, but in the Maritime Provinces, where they have had more moisture, it has turned out very well, so that we have every reason to believe that the introduction of this Russian wheat will be exceedingly valuable to the Dominion. We also obtained seed of many other varieties of wheat, barley, oats and potatoes, to be tested at the Central Experimental Farm. A large part of the farm was in rather rough condition at the outset. Much of it had been occupied by tenants for a number of years, and there was a large amount of stone on the surface. There was also some forty acres of swamp on the back part of it. The greater part of the land was good, but required much work to get it into proper order. The removal of stones and internal fences was promptly undertaken, but by the time the land was got in order it was too late to do very much in the way of seeding.

THIS SEASON'S TESTS.

However, we have tested during the year quite a number of varieties of grain, among the rest 67 varieties of spring wheat, 31 of barley, 60 of oats, and 246 varieties of potatoes. On account of the hot, dry season being unfavourable for grain and potatoes, we have not obtained such good results as we otherwise should have done; but we have succeeded with a considerable number of varieties in obtaining very fair crops, and shall have from the small quantities begun with a sufficiency of seed to test those varieties under more favourable conditions another year.

CLEARING, DRAINING AND BUILDING.

There were on the Experimental Farm about 140 acres of land which was covered with pine stumps, amongst which there was a strong second growth of poplar and birch. This land has all been reclaimed by blowing up the stumps with dynamite, and rooting up the poplars, and it is all now ploughed and ready for cultivation. The farm has also been fenced and got into such shape that good results may be expected another year. There will be room enough in the area acquired—465 acres—to test all the varieties of produce

to which reference has been made. The forty acres of swamp have been drained, and barns and stables are being erected for the accommodation of stock and horses. These buildings will be completed in the course of a few weeks and will be large enough to accommodate about 75 head of stock and a sufficient number of horses for the farm work, so that the foundation will be laid for operations in this direction another year. Dwellings are being erected also for the superintendents of the different departments, so that they can reside on the place and devote their whole time to the work. Plans have been prepared for a laboratory and a museum of the products of the farms for the benefit and instruction of visiting farmers, and offices will be provided in the same building for the transaction of business.

A REPRESENTATIVE CLIMATE.

Ottawa may be said to be fairly representative in climate of a large area in the two provinces of Ontario and Quebec; hence it is important to determine there not only what cereals and farm crops can be raised, but also what varieties of fruit can be produced, as fruit trees are generally taken by strangers and visitors as an indication of the character of the climate prevailing in the district, and are appreciated much more readily than crops of grain or roots would be. It is also important that the people in every district should be able to grow their own fruit, and thereby add not only to the attractiveness of their homes and surroundings, but also to the profits attending farm work. The impression has prevailed that the Ottawa district is not a good fruit growing section; but I think it is quite possible and wholly probable that varieties of fruit can be introduced which will be found exceedingly useful and very profitable to cultivate. On the farm there have been planted, under the direction of the horticulturist, W. W. Hilborn, 1,000 apple trees, including 297 different varieties, 298 pears, of 114 varieties; 197 plums, of 72 varieties; 11 varieties of peaches; 4 of apricots and 27 of crab apples. In small fruits also a great deal has been done. The planting includes 127 varieties of grapes, 90 of strawberries, 37 of raspberries, 21 of blackberries and 16 of currants, besides which there are a number of new seedlings being tested. We do not expect or hope that all those varieties will be useful, but it is expected that among them will be found some of superior excellence which will be adapted to the needs of the community here, as well as some fitted equally well for other climates of the Dominion. As to the botanical and entomological departments of the work, the officer in charge of them (Mr. Fletcher) is here and will speak for

himself. A skilful chemist, Mr. F. T. Shutt, has been appointed, who will undertake the analysis of soils, crops, grasses, etc.; also the analysis of milk from the different breeds of cattle, and such other chemical work as may be needed.

A POULTRY DEPARTMENT.

It is also proposed to establish a poultry department. The development of the poultry interest in Canada has been very rapid, and the exports of poultry products now foot up a sum that is astonishing. They exceed in amount our exports of horses, and it has become a subject of such importance that it is thought necessary that some experiments in that line should be carried on to determine the relative value of the different breeds and crosses for the production of eggs and dressed poultry for the markets. Enough has been said, I hope, to show the importance of this great undertaking for the benefit and advancement of agriculture, in which both the Premier and the Minister of Agriculture take so warm an interest. No effort will be spared to make these institutions a success, and they will, I trust, stand as permanent proofs of the wisdom and forethought of our great statesmen, the Premier, and the Hon. the Minister of Agriculture, and confer lasting benefits on the farmers of Canada. (Applause).

Mr. Fouell—I would like to ask Prof. Saunders if the soil absorbs the nitrogen contained in the second growth of clover that is allowed to remain on the ground and rot?

Prof. Saunders—I should scarcely expect that that portion of the nitrogen which is contained in the foliage of the plant would be so well preserved to the soil when it is allowed to remain on the surface, as when ploughed under; but the analysis of the roots of clover shows that a much larger proportion of nitrogen exists in the roots than in the leaves; so that the fact of the clover growing there would enrich the soil, and some portion of the nitrogen in the leaves, by the process of decay, would eventually become incorporated with the soil and act as a fertilizer.

Mr. Darling—At what state in the growth of the plant would the most benefit be derived by ploughing it under?

Prof. Saunders—Plants are always richest in their constituents about the flowering period. It might sometimes be considered too great a sacrifice of the crop to plough it under when fit to cut for hay; but that is the time when the ploughing of it would be of the greatest benefit to the soil.

Mr. Moffat—Have you yet undertaken any experiments to determine the best

breeds of cattle for dairying purposes in Canada?

Prof. Saunders—Not yet; we are waiting until the necessary buildings are put up, when it is intended to undertake, as fast as practicable, those different departments of work. Those which seem to the Minister to be most pressing will, of course, be the first undertaken. It will be impossible to undertake every department at the outset, as there are five different farms to be established and organized.

Insect and Plant Parasites.

Mr. FLETCHER was next called upon to address the Institute. He said: It is a great pleasure to one who makes a special study of any particular branch of knowledge, which he considers is of use to the community at large, to have the privilege of addressing such a meeting as this. Those who take the trouble to attend these meetings are the men who take the most interest in the work with which such institutes as yours are concerned, and, therefore, though the attendance may sometimes be small it must always be conceded that those who come represent the best class of your members and are the ones who will derive most benefit from such meetings. Prof. Saunders has told you that he hoped to get some information from you that would be useful in his work at the Experimental Farm. This is no less the case with me in the departments which have been placed under my charge at Ottawa, and I hope I may be able to show you that it will be to your advantage to assist me. He has told you that I am the Entomologist and Botanist of the institution. It is true this is my title, and these are fine sounding words, but they are not easily enough understood by everybody, so when I am asked what my work is, I answer—to study injurious insects and plants and the best remedies to keep them down. As you all know, a very large proportion of your crops is taken away from you, year by year, by insects; there is also a large amount destroyed annually by injurious plants.

THE ENTOMOLOGIST AND BOTANIST.

I will now with your permission give you some idea of the work it is proposed to carry out in my departments at the Central Experimental Farm at Ottawa. There are two kinds of injuries to crops, which as Entomologist and Botanist I shall have to consider, namely, those diseases of plants due to insects and those due to vegetable parasites. I believe it is possible that in relation to them the work of the division may be made of great use to the country at large. I have undertaken it with a great deal of enthusiasm, believing that much good will come of it, and I shall do my best

to make this branch of our experimental work succeed; but I shall look to the farmers for assistance. In a vast territory like Canada it is impossible that any one man can take in the whole field of observation alone. It is possible, however, if that one man gives all his attention to the work and he is assisted by correspondents in the different provinces that his studies may bring about results of general benefit to the whole Dominion. It is in the hands of every farmer who is a practical observer and who grows his crops with all his mental energies directed towards their improvement to aid by sending in the result of his observations. It has been said that the ordinary farmer is unable to assist in these scientific studies. This is not the case. A very small fact is of value if it is the result of what the farmer has actually seen take place on his farm, a true record of that one fact is of itself important, and when added to the observations of others may fill a missing link in our knowledge on any given subject, and is, therefore, of great use to science, for science is simply a word that is used for "the best knowledge." It is a word that is apt to frighten people, but it is only the Latin word for knowing or knowledge. Then if you will help by sending in any small facts that come under your notice they will be an assistance to other farmers all over the country, for they will be incorporated in reports and will be distributed far and wide all over the Dominion. Arrangements have been made by which this intercourse can be facilitated with the least possible trouble and expense to farmers. When crops show signs of disease it is of great importance to discover the nature of the injuries and see whether they are of insect or vegetable origin. If anyone finds his crops attacked in any way, and he will send specimens of the plants attacked—this can be done free of postage—in most cases information respecting the trouble will be obtainable from the Experimental Farm at Ottawa. Efforts will be made to have this institution recognized as a

BUREAU OF INFORMATION

to which any farmer who desires information concerning agricultural matters can write. It is hardly likely that the director will have time to attend to all these himself; but he will hand the letter to whoever the officer may be in charge of the special department inquired into, and the desire of the director is, as he has told you, that farmers should not hesitate to write to him for any information whatever concerning their farming operations. Those inquiries requiring information concerning insects or plants, will come to me, and I shall

attend to them at once, and shall endeavour to give you as much information as possible. As well as letters, you can send samples to Ottawa to our headquarters to be examined and reported upon free of charge. This is an important advantage to you. Frequently

FARMERS LIVING AT A DISTANCE
from town have no postage stamps on hand, and they may say "I will let this stand until I go to town when I can take it in and have it posted," but in these cases it is frequently forgotten until too late. They need not delay on that account; they have only to take their samples to the post-office in proper packages, throw them in, and they will be at once forwarded free of postage, and the answer will come back as quickly as possible. There is no doubt at all that a report on the different kinds of injuries from insects and parasitic plants is very advantageous to all farmers to read and study. If a farmer knows that a certain injury is going on in one part of the country—either the attack of an insect or a fungous disease, he will keep his eyes open to ascertain what remedy is discovered, in case he receives a visit from the unwelcome stranger; for although all these studies are of great interest in themselves they are of very little use to the country if we do not find remedies for the attacks. This is our chief aim. We hope by getting men who devote all their time to these subjects, study hard and work them out from the beginning, to find remedies for all these diseases. There are a great many for which remedies have not yet been found; but on the other hand a good deal of work has been done by scientific men with good results although they do not always get the credit of it. What farmer, when he buys five cents' worth of Paris green and saves his potato crop, thinks of the men who spent years in hunting for a sure and cheap remedy for killing the potato bugs? Yet we could not attempt to-day to grow a crop of potatoes in some parts of Canada without Paris green any more than we could without manure.

INJURIOUS INSECTS.

Let me now say a few words with regard to the injuries committed every year by insects. These are so enormous and so well known that probably no one here will challenge the propriety of the Government having appointed someone to devote his whole time to the study of the best means of keeping their ravages within bounds. I will give you a few figures which have been carefully verified as to the extent to which these injuries may reach. In the first place, it may be stated generally that 10 per cent. of all crops grown is annually destroyed by insects. Frequently, however, this propor-

tion is far exceeded. In 1882 one of several kinds of insects which attack the hop in England reduced the crop by the value of \$13,000,000. In the 1874 report of the United States Commissioner of Agriculture it is stated that the loss on the cotton crop by insects is about \$25,000,000 a year. In 1873 the money value of wheat and corn destroyed in the State of Illinois by one insect called the chinch bug was \$73,000,000. No wonder then that there is consternation at the present time in that State where this insect has again appeared in numbers. To come nearer home, in 1854 the wheat midge destroyed in Canada 8,000,000 bushels of wheat. It becomes a necessity then that someone should be appointed to investigate these subjects and try if possible to find practical remedies which farmers can apply for themselves. I have stated that ten per cent. of all crops is destroyed by these pests. I believe I might without exaggeration say twice this amount, but it is better to be under than beyond the mark. You may say, "This is all very fine your telling us about these losses by insects—have you any remedy—can you give us any hope of relief from their ravages?" I answer, yes; certainly I can if you will help me. I believe that all these insects, when their life-histories are studied out and their habits ascertained, can be kept down in a very large degree. Let me give you one instance which I have frequently cited before, because it is taken from the practical work of practical men. If you will take the trouble to look up the last census you will see that the revenue from one small crop—the clover seed crop—was half a million dollars at the time the census was taken. Three years ago the revenue from that crop was reduced to nothing. There was not a grain of clover seed exported, and why? Because a little fly, so small that it would lie on the head of a pin, had gradually worked its way up from the United States and had got into our clover fields and attacked them so severely that there was no crop to reap. People began to give up growing clover seed. Finally the farmers put their heads together and consulted with those who studied insects, and said, "here is a great trouble coming upon us, and we must have some remedy." "Well," said the entomologists, "let us look into the matter and find out what is the nature of the insect, and what is its life-history, and then perhaps we can find a remedy." Now, I will mention here what perhaps some of you know, before insects attain their perfect development they pass through four stages. When we talk of the borer in the apple tree to a man who knows nothing of the lives of insects and say, "you must put something obnoxious on the bark of your tree at the

time the eggs are laid to keep the beetle away;" such a one would say, "this is not a beetle, it is a soft grub." This is true; but it was not always a soft grub, nor will it always remain so. All insects go through four distinct stages of existence: First, there is the little egg, which is laid by the mother insect; this hatches into a soft grub-like, active insect which passes its life eating, until it is full grown; from this it changes into what we call the chrysalis state, in which it has generally the limbs of the perfect insect apparent, but in most orders of insects lies quiet and cannot use them; from this chrysalis, after a time, emerges the perfect insect. Now, let us apply this life-history to the clover seed midge: The farmer wanted to know how to stop the ravages of the midge. So he set to work to find out its life-history. He examined the heads of clover seeds, rubbed them up in his hands, and found that the pod which should have held the clover seed was all right in appearance; but on opening it, instead of a seed, there was a little red grub inside. How did it get there? I will tell you: Let us start in the middle of June when we shall find the grub in the seed. We put the head of seed into a glass jar and watch to see what happens. Towards the end of the month—remember that date—the little grub works its way out of the clover and falls to the ground; here it burrows down below the surface and remains there for some weeks. The farmer who knows nothing of insects cuts his clover about the beginning of July, and is surprised to find no seed. He thinks, however, he may have better luck with the second crop; but just about the time this is in flower the little grubs which had gone into the ground in June have matured, and the perfect insects—tiny midges—appear. These begin operations at once, and the females lay a single egg in each clover flower, which hatches and the young worm works its way down into the pod, and before it is full grown has consumed the whole contents. Now, how are we to stop it? Simply by getting the clover off the fields before the end of June. It was found by experience that by cutting the clover before the first brood came to maturity, or turning in cattle to feed on it, a large number of these insects was destroyed, and there were consequently few left to lay eggs in the second crop. So the farmers in the west where they grow clover seed, now reap only one crop where they formerly grew two in a season. They either cut their clover soon after the middle of June or turn in their cattle to eat it so that it may not stand in the fields till the end of the month; because if they waited until then, the little insects would have come

out of the clover and gone into the ground, whence they would emerge in due time to attack the next crop. By persevering in this course the farmers have gradually thinned out this pest, and will, I believe, eventually get rid of it altogether. Another benefit which has come from the study of entomologists must be mentioned, namely, the use of Paris green as an insecticide. This was not discovered by accident; it was the result of direct study in seeking for a remedy for the potato bug. During the last few years

THE POTATO BUG

has increased so much that we now have to use this remedy, as a matter of course. It is not known by all farmers that the remedy is perfectly harmless when applied to this crop. I make this statement because there is in some sections a wrong impression about it—it is stated that the potatoes absorb it; now, it is utterly impossible to poison the potatoes by putting arsenic, which is the poisonous principle of Paris green, on the soil. The potato tuber is merely a receiver of food for the nourishment of young plants, which are represented by the eyes. It is not a root, but a swelling in an underground stem, and the eyes are buds. It is provided by nature as a reservoir of special food for the young plants in the following year. Very little of this nourishment came in through the roots. The largest amount of substance, the starch, that is stored up in the tuber of the potato, was taken in an elementary condition through the leaves. It is perfectly absurd then to talk of arsenic being taken up in the roots and stored in the tuber of the potato plant. Spraying with a weak mixture (only two ounces in 40 gallons of water) of this material has been discovered to be the best remedy for the injurious codling moth which destroys our apples. This insect is so injurious that in some years it destroys as much as 80 per cent. of the whole crop. By the use of this remedy it has been found that 75 per cent. of the whole crop can be saved every year. I believe that if it were applied generally over large areas we could eventually get rid of the codling moth altogether. More men are studying this economic aspect of insect life year by year, and we are gradually becoming able to keep in check most of the worst insect enemies with which the farmer has to contend. But there are still a great many of these pests which are doing an enormous amount of injury, and for which we have not yet found practicable remedies. These it will be my duty to study for this purpose. There is one of these which attacks the wheat crop, concerning which I wish to enquire particularly. It is called the wheat bulb worm, and has ap-

peared lately in this district. The indication of its attack is probably known in your district as "silver top." The appearance of the disease is this. The young ear of wheat turns white prematurely before the rest of the crop is ripe, and when you pluck it you will find there are no grains in it. If you will examine it carefully, you will find that there is a very small transparent maggot inside the stem above the top joint. You will notice at once these dead ears of wheat in fields where this pest is at work. I fear, too, there is now no doubt but that it has been increasing in numbers during the last year or two. It is a very difficult insect to combat, from the fact that it matures and leaves the wheat stem before the main crop is fit to cut; consequently it has escaped and is ready to lay its eggs for the next crop. There is a little gap in our knowledge of the life-history of this insect. We know that it passes through two different circles of life. First of all it exists in the first brood in the straw of standing wheat; then there is a long gap between that time, from about the beginning of July until September, during which we know nothing of its habits, but we find that in September the perfect fly appears again and lays its eggs on the sprouting fall wheat, and the little maggots eat their way down to the base of the stem of wheat, from which it is called the "wheat bulb worm," and remain there all winter in the root of the wheat, just in the same way as the insect which you all know too well, the "Hessian fly," which also passes the winter in the root of the wheat. There is then a gap between the summer and the autumn broods, which I want to find out something about. Very

FEW INSECTS ARE LONG LIVED.

This insect has a long life for so small a fly—not a quarter of an inch in length. Some that I enclosed in glass jars lived for three weeks without any food at all. This proves that it can live a long time, but it is hardly possible that it can live in the winged state for two or three months in summer. We know that the maggot lives through the winter in the wheat plant, and I think it is possible that it attacks some of our wild grasses and that an intermediate brood lives in them during the period of which we have no trace of its habits. This is one of the pests for which we are anxious to find a remedy, and in which you can all help me. One of my correspondents reported that one in every thirty heads of his wheat was destroyed by this insect last summer. Now there are certain broad general principles for your guidance when you find your crops attacked, and these are founded upon very

simple rules. In the first place, if you examine a large number of different insects you will find they may all be divided into two large divisions by the nature of their mouth parts. In one these will be found to consist chiefly of a pair of jaws with which they tear the substance of their food; in the other there is, instead, a tube by means of which the insects suck up their food in the shape of liquids. For the first class it is apparent that any poisonous substance placed on the food will be consumed with it and the insects destroyed. It is, then, merely a matter of getting some material not injurious to the plant, but which will kill the insects preying upon it. Such we have in various compounds of arsenic, as Paris green and London purple. For the other class, which could push their beaks through the poison and then suck out the juices from the plant beneath, we must have recourse to other methods, such as those which will kill by coming into contact with the bodies of the insects or by virtue of some noxious volatile principle. One of these we have in Persian insect powder. Of all the numerous insects which attack vegetation and some plants are attacked by as many as 200 different kinds, I suppose there is not one for which a remedy of some sort could not be devised; but the trouble is we must find remedies which are practicable, such as while they attain the object aimed at are yet of such a character as not to lay us open to the accusation that the remedy is worse than the disease. There are

THREE SIMPLE RULES FOR THE APPLICATION

OF ALL INSECT REMEDIES.

First, they must be effectual; secondly, they must be economical; thirdly, they must be simple. Most of the substances used are direct poisons and many of them are costly. The remedies suggested must be devised with special regard to these points or they will be useless, and, simplicity is a most important feature, for if they require much care in their application or preparation not only may they not be used in the right proportions, but they will probably not be used at all. Remedies may be divided into three classes; first and most important—1, agricultural, by which is meant such methods as, a judicious rotation of crops; planting and reaping at a different time to that usually adopted; the selection of seed less liable to attack; the use of special fertilizers and the alluring to a more attractive food plant. 2. Active, by which poisonous materials are used to destroy insects, and 3. Preventive, by which they are deterred from approaching the plants wished to be protected. This is most easily accomplished by the use of obnoxious materials to prevent the females from laying their eggs where the

young grubs can do mischief. Alkaline washes on trees and carbolic washes for the protection of root crops come under this head. For further details on this subject, I will request any of you who wish to obtain them to write to me at Ottawa.

PARASITIC PLANTS.

The large annual loss to crops is not however entirely due to insects, there are also microscopic fungous diseases which destroy crops. Perhaps one of the most injurious of these on record was one that attacked the coffee crop of Ceylon. In the ten years, 1869 to 1878, \$60,000,000 of injury was done by this one variety of parasitic fungus. We also know that our wheat is apt to be attacked by "rust" and "smut." These again are parasitic fungi, and although we have not yet found any practical remedy for rust I am in hopes we may be able to do so. For smut, however, we have a very easily applied remedy which is efficacious. It has been known for upwards of 200 years that by washing seed wheat with a solution of bluestone the plants from seed so treated are more exempt from the attacks of this low form of vegetable life than wheat sown without such treatment. In England the farmers seldom sow wheat without first washing it with bluestone, and the consequence is that smut is not at all prevalent in the wheat fields of England. Now, what steps should be taken by farmers when they find their crops attacked by disease? First of all they should examine them carefully to find out whether it is an attack of a fungus or of an insect. For fungi it is more difficult to find a remedy that can be applied at once, but steps can be taken to prevent in the following year a repetition of the evil. No sane person will reside in a locality which he knows is infested by any contagious disease. In the same way it is very foolish for us to plant good seed in a field in which we know that the summer before the crop had been destroyed by some disease. Besides the weeds which give so much trouble there are some other injurious plants which it is possible you may not some of you recognize as plants. For instance, it does not occur to many farmers when they see "rust" and "smut" on their wheat, or the "black spot" on their apples, that these are plants. As a matter of fact, however, they are just as much plants as those on which they are found; but they are of quite a different nature, for they are parasites and derive their nourishment from the larger plants upon which they grow. All their parts are exceedingly small, and it is necessary to examine them with the aid of powerful magnifying glasses before we can

understand the secrets of their lives. The smutty ears and the rusty discoloured spots on the leaves and straw of wheat are not the whole plants; but merely the fruit consisting of collections of innumerable seeds—or, as they are called when speaking of fungous plants, spores—each one of which is so small as to be invisible to the naked eye, but which, nevertheless, is capable of infecting a whole wheat plant should it come in contact with its tissues—I have said that what we see is only the fruit. You may say "where then are the other parts of these mysterious plants?" I will tell you. In the case of the "smut" the spore lies in the ground or is carried there upon the seed, and when the young wheat plant begins to grow this enemy forces its roots into the tissues and soon permeates the whole plant. By the time it has found its way up to the ears it is mature and ready to produce its fruit in the shape of the black, sooty powder, the appearance of which you all know so well. The poor wheat plant all this time has been robbed of its nourishment by this parasite living inside its tissues, and is unable to produce its seed. The spores of the fungous which produce "rust" do not act quite in the same way, but are carried by the wind and settle on the leaves or stem, and there send out their roots, which find an entrance between the cells and spread out in all directions, sucking up the nourishment and strength which should have gone to produce the grain of the wheat plant. The result, however, is nearly the same, the weakened straw is unable to carry up nourishment sufficient for the grain to properly fill out, and there is, consequently, a great deficiency in the amount of seed produced. There are, however, certain preventive remedies which can always be applied, the best of which are the judicious rotation of crops and the choice of seed of varieties which are known to be free from attack. On well cultivated farms you do not continue growing the same crops on the same fields year after year. In Canada farmers have ample means of getting information; you take agricultural papers and read them. You use improved methods of rotation of crops, thus securing not only the advantage of the constituents of most use to each kind of crop which is accumulated year by year from the manure, only certain parts of which are used by each crop, but you are also exempt to a large degree from these destructive diseases of which I am speaking. For instance the wheat crop is attacked by rust or smut, and these diseases are allowed to come to maturity and the spores are left in the soil ready to attack the next crop of a

similar nature if sown; but if by rotation of crops you have two or three other kinds of crops following it, the probabilities are that the spores become exhausted and cannot attack the same crop when it is its turn to be sown again. The chief remedies to be applied then for fungous diseases must be preventive, because we know very little about them. I hope in a few years to have studied some of them out, and then may be in a position to prescribe remedies.

A BOTANICAL GARDEN.

There will be at the Experimental Farm at Ottawa a botanical garden and arboretum. An area of sixty-five acres has been set apart upon which trees and plants of economic value will be grown and tested. Plants from other parts of Canada, not growing here indigenously, will be cultivated to see if we can make use of them in this district. Plants from other countries will also be tried to see if we cannot increase the number of useful plants now grown in Canada. As an instance of what may be done in this line, I will mention the Cinchona tree from which quinine bark is taken. For years after its discovery, it was supposed that this would only grow in its native forests of South America, but it is now cultivated over the greater part of the tropical regions of the world, and supplies the product called quinine, which is one of the most valuable medicines known, and, in all tropical climates, is a necessity in the treatment and prevention of malarial fevers. Why should we not be able to introduce into Canada useful trees and plants which we have not now, but which we have plenty of room for. At the Central Farm last season we cultivated some of the fodder plants which are not grown yet in Canada—one of them from the East called "Gram," belonging to the same natural order as the vetches and clover, gives promise of succeeding well here, and, should it do so, is a new fodder plant which may be of great value to farmers.

THE QUESTION OF FOREST TREES

is one of greater importance than farmers are generally inclined to believe. They cultivate their fields for wheat and other crops, but they do not think much about the trees, though the consumption of wood from year to year for different purposes is so enormous that I am afraid to mention the figures. In the United States a report has lately been prepared by Prof. Fernow, the Chief of the Division of Forestry, which shows that the amount of wood used annually for different purposes, for the construction and repairing of railways and bridges, etc., is something appalling. The supply of

wood in our country is being so reduced by lumbering operations, settlement and forest fires, that it is necessary in all parts of Canada to begin at once to renew the supply by tree planting. Year by year the farmers in new districts destroy enormous quantities of timber in clearing their farms, but in a few years they will have to seek for this material at a great distance. This makes it all the more necessary for farmers to undertake the planting of trees on their farms, not only to cover up this loss, but also as wind-breaks and shelters for cattle, and it is very important for them to know beforehand in what way they can do so to the greatest possible benefit. The farmer is not always posted on the most advantageous way of planting. Some will be surprised to hear that with many trees it is more advantageous to grow them from the seed than to transplant them of considerable size from the forest. Again some of our forest trees are very much more valuable than others, and there is much yet to be learned with regard to the best trees to grow on certain soils and in special localities. Extensive experiments will be made in this direction, all of which will be of great use, so that all efforts may be directed in a useful and methodical manner. I will call your attention to two of our most useful and beautiful native trees—the black walnut and the white ash. The first of these is found wild in Canada, only within very restricted limits, and it is supposed by some to grow only in places where it will obtain a considerable degree of heat. As a matter of fact, it has been ascertained that this tree will stand a much greater degree of cold, and will thrive over a much wider area than was at first supposed. At Ottawa it proved to be the second quickest growing Canadian tree. It has been planted in Quebec and has succeeded remarkably well. It was one of the most valuable of our native woods, and is also an extremely rapid growing tree; and although there have appeared during the last few years fabulous statements—which have done a great deal of harm—as to what returns can be had from growing walnuts, there is no doubt that by judicious planting of this tree a quick return for the money can be obtained. Another tree of special value is the white ash. This tree is useful for certain purposes at a moderate size, it grows easily and does not take up much room. When farmers are planting trees they will find it advantageous to know before hand those which will give the quickest returns and those which are the most valuable for timber. As I have said, all such experiments as these will be tried carefully at the Central Experimental Farm.

Large numbers of different trees will be grown from seed for trial in different parts of the country, in order to ascertain where they do best, and what kinds can be grown to the greatest advantage in certain districts. Efforts will also be made to improve the different kinds of grains, fruits and other products. It frequently happens that some varieties have qualities not possessed by others, by hybridising or crossing these it is sometimes possible to produce a new variety with all the good qualities of its parents consolidated. It is not wise to continue all the time with old varieties which we know will succeed; but with such an institution as

THE EXPERIMENTAL FARM

we shall be able to risk failure sometimes in the hope of getting something new and useful, and I understand this is one of the objects with which the farm was established by the Government. No farmer can afford to run the risk of losing a whole year's crop in trying new experiments. The Government by establishing this institution has virtually shown its determination to help the farmers as much as possible. It is not right in such a new country as Canada for individual farmers to have to risk large sums of money in these experiments, important, nay necessary, as they are. So the Government steps in and says, "I will have them done for you and you shall have the benefit of the results." I believe that the results obtained under the present direction will be highly practical; but the work will not end here, it will not be the obtaining of results alone, these will be published periodically as bulletins, written in such a way as to be intelligible to all who may read them, which will be distributed broadcast all over the country.

Mr. Serson expressed himself as being very much pleased with the address. He would like to hear Mr. Fletcher's opinion whether the weather had not something to do with rust. He thought that when warm moist weather prevailed it was more favourable for the production of rust. He would like to know whether in a dry season a clean crop of wheat or oats might not be grown on a field in which in the previous year with a warm, moist summer the crop had been badly attacked by rust.

Mr. Fletcher said there was no doubt that under certain atmospheric conditions all fungus plants were developed more rapidly

than at other times; at the same time they could not come into existence spontaneously, they must all come from spores or seeds. One season you may have planted in such a dry time that the spores do not get a start. You certainly might possibly grow even on the same field where a crop had been badly attacked by rust in the previous year but under different atmospheric conditions, a crop of wheat that might not be affected; at the same time, as a preventive remedy, it would be far better to grow on that field some other crop, clover or roots for instance, than to grow wheat again the following season.

Mr. Serson said he had often seen in a field of wheat rich spots where the wheat would be more affected with rust than on the poorer parts.

Mr. Fletcher said very vigorous growing varieties of wheat would sometimes suffer more from rust than others. Last year, before the Agricultural Committee, the experience of different members of Parliament was given, and the report would be published next session. He had no doubt Mr. Jamieson would be glad to furnish his constituents who wished it with copies of this report. There seemed to be no definite rule that could be laid down with regard to rust on wheat, experience in various localities was so different. One man would complain that a poor or weakly variety was attacked worst by rust, while another would say that a free-growing variety was most attacked. One gentleman went so far as to say that all quick-growing varieties were liable to rust.

Mr. McKinlay said that he had noticed on the coast of Newfoundland that if a foggy morning occurred at a certain period of the year he always found his wheat rusted.

Mr. Fletcher said that in England it was probable that there was hardly a crop of wheat grown which had not been, during some time of its growth, subjected to foggy weather, yet there were many crops of wheat raised there without rust. It might be that if the plant were in an unhealthy condition it would be more susceptible to disease in foggy weather. As a matter of fact this rust on cereals is more widespread than any other vegetable disease known.

An interesting discussion followed, which it was impossible to report owing to the darkness of the room. The meeting closed with the election of officers for the ensuing year.